

Selective Visualization of Hypokinetic Small Bowel Loop using Small Motion Probing Gradient with Low b Value.

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Background and Purpose

CT is the gold standard modality in diagnosis of strangulated small bowel obstruction (SBO). However, its diagnostic criteria are too complicated because it necessitates combination of several findings such as large amount of ascites, mesenteric edema, vascular engorgement, bowel wall thickening, etc. Cine MR imaging is a useful solutions. It allows us to observe peristaltic motion of small bowel loop clearly and depict an akinetic loop, i.e. a strangulated loop. However it is difficult to visualize a strangulated loop selectively because non-strangulated loops also show high intensity on cine MRI.

Recently, the single shot EPI (SS-EPI) sequence with SENSE has been developed. This technique enables high quality diffusion weighted images. Although typically high b-values are used, low b-value images are also useful to detect small hepatic lesions thanks to the flow suppression effect of small MPGs. We hypothesize in this paper that low b-value images may highlight hypo- or akinetic loops by suppression of the signal from the intestinal lumen in adjoining small bowel loops with normal peristaltic function.

Methods and Materials

The study design consists of 1) Volunteer study with and without anti-peristaltic agent and 2) Patient study with SBO. We used a 1.5 Tesla superconducting unit (Intera, 33mT/m max. gradient, 150T/m/s slew rate, Philips, Best, Holland). The sequence with low b-value is as follows: Single shot SE-EPI, SENSE factor 2, TR/TE 4000/64, 6NEX, FOV 45cm, RFOV 70%, Matrix 160, Scan% 80%, b-value 50 sec/mm². Sequence of cine MRI is as follows: balanced TFE, SENSE factor 1.7, TR/TE 3.5/1.3, 1NEX, FOV 38cm, RFOV 100%, Matrix 192, Scan% 133%.

1) Volunteer study with and without anti-peristaltic agent.

Five volunteers (5 men; age 28-44, mean 32y/o) have 1000mL of green tea 10 min prior of the study. Cine MRI and low b-value SS-EPI (b=0, 50sec/mm²) were acquired before and after 1mL of intravenous administration of butyl scopolamine bromide (Buscopan, 20mg/mL; Boehringer, Germany). Signal intensity and caliber of the jejunum was measured. Signal Preserve Ratio (SPR) was calculated as follows. $SPR = SI(b=50)/SI(b=0)$.

2) Patients with SBO (n=6, 3 strangulated, 3 non-strangulated) were examined with MRI using cine MRI and low b-value SS-EPI. Signal intensity and caliber of the small bowel loop was also measured. In patients with a strangulated loop, ROI was set both in the strangulated closed loop and the dilated oral loop. SPR(closed loop) and SPR(dilated oral loop) were calculated.

Results

In volunteer study, SPR(pre) and SPR (Buscopan) was 0.41 ± 0.30 and 0.74 ± 0.13 , respectively. It means signal intensity was preserved more after Buscopan administration. In patient, SPR(dilated oral loop) and SPR (strangulated closed loop) was 0.30 ± 0.15 and 0.88 ± 0.09 , respectively. Thus, a strangulated closed loop retains its signal more than a dilated oral loop with peristaltic motion, even with small MPG of b=50sec/mm². Therefore, closed loop is highlighted on low b value image (Fig.1).

Conclusion

Hypokinetic loops can be visualized selectively on low b-value images. It may be helpful for diagnosis of strangulated SBO.

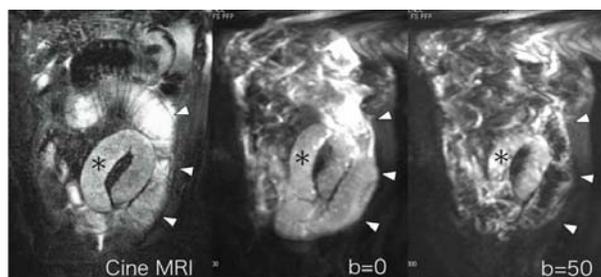


Fig.1 A 65 year old man with strangulated SBO. Cine MRI and SS-EPI image (b=0) image cannot visualize the strangulated loop (*) selectively. On low b-value (b=50 sec/mm²) image, the strangulated loop is highlighted thanks to signal suppression of the dilated oral loop (arrowheads) with normal peristalsis function.